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<p>2004-548082/53</p> <p>TOSHIBA KK</p> <p>2003.01.06 2003-000114(+2003JP-000114) (2004.07.29) C01B 3/02, F01K 17/02, F25J 1/00</p> <p>Exhaust heat utilizing hydrogen-oxygen system has water vapor-electric power generating unit, water electrolysis unit, pure hydrogen and oxygen liquefiers, nitrogen re-liquefier and liquid hydrogen and liquid oxygen storage tanks</p> <p>C2004-201267</p>	<p>E36 H06 L03</p> <p>TOKE 2003.01.06</p> <p>*JP 2004210597-A</p> <p>E(11-N, 31-A2, 31-A3, 31-A5, 31-D1, 31-D2) H(6-A3)</p> <p>L(3-E4)</p> <p>NOVELTY</p> <p>Exhaust heat utilizing hydrogen-oxygen system has water vapor-electric power-generating unit (1), exhaust heat utilizing heat electric power generating unit (5), water electrolysis unit (10), pure hydrogen liquefier (16) and oxygen liquefier (12), a nitrogen re-liquefier (17), and a liquid hydrogen storage tank (18) and a liquid oxygen storage tank (14). The water electrolysis unit has a water purifier for supplying pure water. Water vapor and electric power are produced in the water vapor-electric power-generating unit. Electric power and coolant (23) are produced in the exhaust heat utilizing heat electric power generating unit using an operating medium having a boiling point lower than water and exhaust gas from the water vapor-electric power-generating unit. The electric power from the water vapor-electric power-generating unit and the exhaust heat utilizing heat electric power generating unit are purified in the water purifier and electrolyzed in the water electrolysis unit. The hydrogen gas and oxygen gas from the water electrolysis unit are cooled and liquefied in the respective liquefiers using coolant produced in the exhaust heat utilizing heat electric power generating unit, and stored in the respective storage tanks. The cooled hydrogen gas (30, 34) is liquefied again in the nitrogen re-liquefier, by circulating liquid nitrogen (31). An INDEPENDENT CLAIM is also included for the manufacture of liquid Hydrogen involving pressurizing liquid hydrogen (33, 35) stored</p>	<p>hydrogen liquefier (16) and an oxygen liquefier (12), a nitrogen re-liquefier (17), and a liquid hydrogen storage tank (18) and a liquid oxygen storage tank (14).</p> <p>The water electrolysis unit has a water purifier for supplying pure water.</p> <p>Water vapor and electric power are produced in the water vapor-electric power-generating unit.</p> <p>Electric power and coolant (23) are produced in the exhaust heat utilizing heat electric power generating unit using an operating medium having a boiling point lower than water and exhaust gas from the water vapor-electric power-generating unit.</p> <p>The electric power from the water vapor-electric power-generating unit and the exhaust heat utilizing heat electric power generating unit are purified in the water purifier and electrolyzed in the water electrolysis unit.</p> <p>The hydrogen gas and oxygen gas from the water electrolysis unit are cooled and liquefied in the respective liquefiers using coolant produced in the exhaust heat utilizing heat electric power generating unit, and stored in the respective storage tanks.</p> <p>The cooled hydrogen gas (30, 34) is liquefied again in the nitrogen re-liquefier, by circulating liquid nitrogen (31).</p> <p>An INDEPENDENT CLAIM is also included for the manufacture of liquid Hydrogen involving pressurizing liquid hydrogen (33, 35) stored</p>
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in the liquid hydrogen storage tank of an exhaust-heat utilizing hydrogen-oxygen system, and carrying out adiabatic expansion to obtain liquid hydrogen. The hydrogen-oxygen system comprises a water vapor-electric power generation unit with a steam-generating unit (2), water vapor turbine (3) and generator (4), and an exhaust-heat utilizing cooling-heating electric power generating unit with an absorption refrigerator (9), operating medium steam generation unit (6), operating medium steam turbine (7) and generator (8).

USE

Used as a power source for motor vehicles.

ADVANTAGE

The exhaust-heat utilizing hydrogen-oxygen system manufactures liquid hydrogen and oxygen, without ejection of carbon dioxide.

DESCRIPTION OF DRAWING

The figure shows the structure of the exhaust-heat utilizing hydrogen-oxygen system. (Drawing includes non-English language text).
Water vapor-electric path generating unit 1
Steam generating unit 2

Water vapor turbine 3

Generator 4,8

Exhaust-heat utilizing cooling-heating electric power generation unit 5

Operating medium steam generating unit 6

Absorption refrigerator 9

Water electrolysis unit 10

Heat exchanger 11,15

Oxygen liquefier 12

Water purifier 13

Liquid oxygen storage tank 14

Pure hydrogen liquefier 16

Nitrogen re-liquefier 17

Liquid hydrogen storage tank 18

Coolant 23

Pure water 25

Liquid oxygen 27,29

Hydrogen gas 30,34

Liquid nitrogen 31

Liquid hydrogen 33,35

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TECHNOLOGY FOCUS

Mechanical Engineering - Preferred Components: The water vapor-electric power generating unit (1) comprises a steam generating unit which produces electric power and water vapor, carbon dioxide liquefier which liquefies carbon dioxide generated by combustion of fossil fuel, biomass fuel or waste material fuel in the presence of oxygen, and liquid carbon dioxide storage tank for storing liquefied carbon dioxide.

The hydrogen-oxygen system comprises heat generator which heat pure water of unit (10), using steam from the steam turbine.

The oxygen liquefier is equipped with a heat exchanger (11) which recovers heat from the coolant for compressing oxygen gas with a compressor.

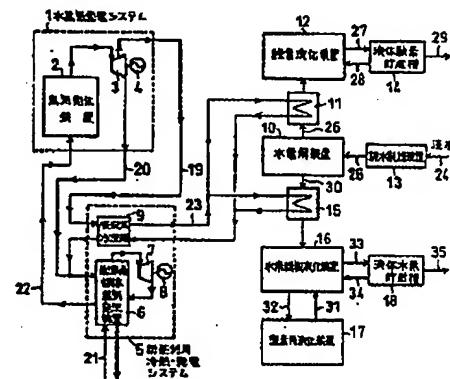
The nitrogen re-liquefier is equipped with a heat exchanger (15) which recovers heat from the coolant for compressing nitrogen gas with a compressor.

The hydrogen liquefier is equipped with a heat exchanger which recovers heat from the coolant for compressing hydrogen gas with a compressor.

Preferred Process: The ultra-low warming-cooling medium supplying

cycle in the hydrogen-oxygen system pressurizes and cools liquid hydrogen. The oxygen liquefier pressurizes one portion of liquid oxygen and produces liquefied oxygen gas. The nitrogen re-liquefier pressurizes composition of liquid nitrogen and produces liquefied nitrogen gas.

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